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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/709,776

05/27/2004

William G. America

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EXAMINER

IM, JUNGHWA M

ART UNIT

PAPER NUMBER

2811

MAIL DATE

DELIVERY MODE

05/17/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/709,776

Applicant(s)

AMERICA, WILLIAM G.

Examiner

Junghwa M. Im

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 February 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7 and 21-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 and 21-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3 and 6-7 are rejected under 35 U.S.C. 102(b) as being anticipated by Smith et al (US Pat. 6,255,233), hereinafter Smith.

Regarding claim 1, Fig. 3 of Smith shows a semiconductor device comprising:

a substrate [50;wafer substrate] including silicon;

a dielectric [150,160, 180, 190, 200] atop the substrate, the dielectric layer including a first dielectric sub-layer [200; SiOF] , a second dielectric sub-layer [180; SiN] and a first non-discrete transitional dielectric sub-layer [190; graded silicon oxynitride; col. 3, lines 51-57] residing between the first and second dielectric sub-layer layer, wherein the first dielectric sub-layer has an etch resistance different than the second dielectric sub-layer, and

an opening [185] extending no deeper than the sub-layer nearest the substrate;

wherein a composition of the first non-discrete transitional dielectric sub-laver varies gradually through thickness thereof from a first composition substantially the same as the first dielectric sub-layer where the first non-discrete transitional dielectric sub-layer contacts the first dielectric sub-laver to a second composition substantially the same as the second dielectric sub-

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layer where the first non-discrete transitional dielectric sub-layer contacts the second dielectric sub-layer (Abstract)

Regarding claim 2, Fig. 3 of Smith shows that an etch resistance of the first dielectric sub-layer [SiOF] is greater than an etch resistance of the second dielectric sub-layer [SiN].

Regarding claim 3, Fig. 3 of Smith shows that the first dielectric sub-layer [SiOF; fluorinated silicon oxide] has a greater content of fluorine than the second dielectric sub-layer [SiN].

Regarding claim 6, Fig. 3 of Smith shows that the dielectric layer includes a third dielectric sub-layer [150; SiN] residing between the substrate and the first dielectric sub-layer and a second non-discrete transitional dielectric sub-layer [160; graded silicon oxynitride; col. 3, lines 51-57] residing between the third dielectric sub-layer and the first dielectric sub-layer.

Regarding claim 7, Fig. 3 of Smith shows that the second dielectric sub-layer [180; SiN] and the third dielectric sub-layer [150; SiN] have substantially the same etch resistance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 4-5 and 21-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith in view of Todd (US Pat. 6,733,830).

Regarding claims 4 and 5, Fig. 3 of Smith shows most aspects of the instant invention except “the first dielectric sub-layer includes at least one component not included in the second dielectric sub-layer, the at least one component being selected from a group consisting of fluoroalkylsilanes, fluoralkylsiloxanes, perfluoroalkylsilanes, perfluoroalkylsiloxanes, alkylsilanes, and allcylsilaxanes while the at least one component is selected from a group consisting of methylsilane, dimethylsilane, trimethylsilane, trifluorvmethylsilane, 1,2-disitanotetrafluorethylene, 1,3-bis(silanodifluoromethylene)disiloxane, 2,2-disilanohexafluorosilane, bis(trifluoromethyfdisiloxanyl)difluormethane, octamethylcyclotetrasiloxane, and tetramethylcyclotetrasiloxane.” Todd discloses the first dielectric sub-layer includes at least one component not included in the second sub-layer, that is, the first dielectric sub-layer being fluorinated through the at least one component being selected from a group consisting of fluoralkylsiloxanes and alkylsilanes (col. 7, lines 48-55).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings Todd of into the device of Smith in order to have the first sub-layer including at least one component not included in the second sub-layer, the at least one component being selected from a group consisting of fluoralkylsiloxanes and alkylsilanes to reduce the etch rate.

Regarding claim 21, Fig. 3 of Smith shows a semiconductor device comprising:
a substrate [50;wafer substrate] including silicon;
a dielectric [150,160, 180, 190, 200] atop the substrate, the dielectric layer including a first dielectric sub-layer [200; SiOF] , a second dielectric sub-layer [180; SiN] and a first non-discrete transitional dielectric sub-layer [190; graded silicon oxynitride; col. 3, lines 51-57]

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residing between the first and second dielectric sub-layer layer, wherein the first dielectric sub-layer has an etch resistance different than the second dielectric sub-layer, and an opening [185] extending no deeper than the sub-layer nearest the substrate; and

wherein a composition of the first non-discrete transitional dielectric sub-layer varies gradually through thickness thereof from a first composition substantially the same as the first dielectric sub-layer where the first non-discrete transitional dielectric sub-layer contacts the first dielectric sub-layer to a second composition substantially the same as the second dielectric sub-layer where the first non-discrete transitional dielectric sub-layer contacts the second dielectric sub-layer (Abstract).

Fig. 3 of Smith shows most aspects of the instant invention except the first sub-layer includes at least one component not included in the second sub-layer, the at least one component being selected from a group consisting of fluoroalkylsilanes, fluoralkylsiloxanes, perfluoroalkylsilanes, perfluoroalkylsiloxanes. Todd discloses the first dielectric sub-layer includes at least one component not included in the second sub-layer, that is, the first dielectric sub-layer being fluorinated through the at least one component being selected from a group consisting of fluoralkylsiloxanes and alkylsilanes (col. 7, lines 48-55).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings Todd of into the device of Smith in order to have the first sub-layer including at least one component not included in the second sub-layer, the at least one component being selected from a group consisting of fluoralkylsiloxanes and alkylsilanes to reduce the etch rate.

Regarding claim 22, Fig. 3 of Smith shows that an etch resistance of the first dielectric sub-layer [SiOF] is greater than an etch resistance of the second dielectric sub-layer [SiN].

Regarding claim 23, Fig. 3 of Smith shows that the first dielectric sub-layer [SiOF; fluorinated silicon oxide] has a greater content of fluorine than the second dielectric sub-layer [SiN].

Regarding claim 24, Todd discloses the first dielectric sub-layer includes at least one component not included in the second sub-layer, that is, the first dielectric sub-layer being fluorinated through the at least one component being selected from a group consisting of methylsilane, dimethylsilane, trimethylsilane, trifluoromethylsilane, 1,2-disilano-tetrafluoroethylene, 1,3-bis(silano-difluoromethylene)disiloxane, 2,2-disilano-hexafluorosilane, bis(trifluoromethyl-disiloxanyl)difluoromethane, octamethylcyclotetrasiloxane, and tetramethylcyclotetrasiloxane (col. 7, lines 48-55).

Regarding claim 25, Fig. 3 of Smith shows that the dielectric layer includes a third dielectric sub-layer [150; SiN] residing between the substrate and the first dielectric sub-layer and a second non-discrete transitional dielectric sub-layer [160; graded silicon oxynitride; col. 3, lines 51-57] residing between the third dielectric sub-layer and the first dielectric sub-layer.

Regarding claim 26, Fig. 3 of Smith shows that the second dielectric sub-layer [180; SiN] and the third dielectric sub-layer [150; SiN] have substantially the same etch resistance.

Response to Arguments

Applicant's arguments filed February 27, 2007 have been fully considered but they are not persuasive.

Applicant argues that "... Smith does not disclose, inter alia, that 'a composition of the first non-discrete transitional dielectric sub-layer varies gradually through thickness thereof from a first composition substantially the same as the first dielectric sub-layer where the first non-discrete transitional dielectric sub-layer contacts the first dielectric sub-layer to a second composition substantially the same as the second dielectric sub-layer where the first non-discrete transitional dielectric sub-layer contacts the second dielectric sub-layer.' In Smith, the silicon oxynitride layer 40, 190, which are alleged to disclose the first non-discrete transitional dielectric sub-layer of the claimed invention, do not have a first composition substantially the same as silicon nitride layers 20, 180, and do not have a second composition substantially the same as silicon oxide layer 30/SiOF layer 200. In Smith, the percentage of oxygen in the silicon oxynitride layer 40 changes, but the composition of silicon oxynitride layer 40 is not substantially the same as silicon nitride layer 20 at interface 50, nor substantially the same as silicon oxide layer 30 at interface 60." Note that it is obvious that in reality a non-discrete transitional layer is formed at the interface of two stacked dielectric layers. And again in reality the composition of the interfaced layer between the two dielectric layer is gradually changed in a manner as recited in the instant invention. Therefore, Smith shows that the bottom interface layer 50 between the nitride layer 20 and the oxinitride layer 40 would be substantially nitride and the top interface 60 between the oxide layer 30 and the oxinitride layer would be substantially oxide. Furthermore, Abstract of the Smith reference explicitly discloses "the oxinitride layer is graded, to form a gradual change in composition of nitrogen and oxygen within the film."

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

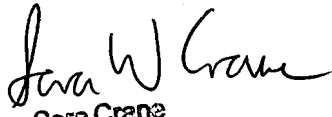
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (571) 272-1655. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard T. Elms can be reached on (571) 272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JMI


Sara Crane
Primary Examiner